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ABSTRACT

Recent research indicates that low income adults and infants in the United States are more likely to be overweight than undernourished. Very possibly, the assumptions upon which food supplement programs are based are ill-founded. While many of the currently operating broadly conceived supplemental food programs achieve desirable collateral benefits, they may prove to be stop-gap measures that are less important than other steps that should be taken to ensure the health, well-being and future social competence of children and youth. To establish a sound basis for food policy, further research on nutrition is needed (or will continue) in several areas, including (1) the effects of adult obesity on health; (2) the contribution of infant obesity to adult obesity; (3) the role of diet in the genesis of degenerative vascular diseases; (4) the potential role of specific foods, food components and food additives in the etiology of various malignancies; (5) the need for trace minerals in the diet; (6) the identification of normal mechanisms of intestinal absorption and the role of gastrointestinal flora; (7) cell-mediated immunity; (8) the advantages and risks of breast feeding; and (9) the influence of nutrition on hyperactivity. Nutrition policy should make certain of the nutritional value and safety of convenience foods and intelligently inform the public about them. (Author/RH)

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MATRIX NO. 3

NUTRITION AND GROWTH: RECENT RESEARCH FINDINGS AND RESEARCH PRIORITIES

by

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NUTRITION AND GROWTH: RECENT RESEARCH FINDINGS AND RESEARCH PRIORITIES

The past decade, ushered in by *revelations* of the supposed widespread hunger and malnutrition in the United States, has witnessed an explosive increase in the public's and its elected representatives' concern for nutrition and its impact on growth, health and longevity. This concern has contributed to a healthy revival of interest in nutrient requirements and deficiencies, to the refinement of inexpensive epidemiologic methods for detection of the latter, and to a gradually increasing implementation of these methods at the national and state levels. It also has resulted in the proliferation and expansion of government-funded programs designed to make certain that all children eat enough of the right foods, and, as a result, grow to their maximum genetic potential; do well in school; and become law-abiding citizens.

Lost in the enthusiasm for these programs has been the fact that the 1968-70 Ten State Nutrition Survey, targeted at the lowest income populations, still failed to confirm the existence of widespread undernutrition and did identify a high prevalence of overnutrition. Subsequent national surveys have generated further evidence of impressive overweight, most notably in those segments of society characterized by dietary surveys as having inadequate total calorie intakes, when these are judged against officially sanctioned recommendations.

A number of studies have revealed a high prevalence of infantile overweight in the very same populations, who are the prime recipients of most food programs. At the time of enrollment in the popular Supplemental Food Program for Women, Infants and Children (WIC), the CDC has found infants to be already heavier for their body lengths than the most recent NCHS reference population. In another study involving WIC participants, Mexican-American 1-year olds were found to be heavier than participating white infants of the same age or the NCHS reference; American Indian infants were found to be even heavier. An earlier evaluation of the WIC program claimed enhanced average gains in weight by the participants, but an examination of the data reveals that most of the increase in the average was accounted for by the weight gained by those who were already normal or heavy at the time of enrollment. Based on the popular but unproven assumption that obesity may be caused by eating *the wrong foods* instead of too much food and too little activity, infants and children are enrolled in many WIC programs because they are overweight as well as underweight. Pregnant women, who have gained too much weight, also are enrolled, along with those who have gained too little, probably based on the same assumption.

One major United States study, carefully designed to measure the effect of two different dietary supplements on the outcome of pregnancy in mothers with expectedly poor reproductive performance, resulted in only minimal increases in birthweight, almost exclusively in the smoking mothers who did increase their total food intake. The apparent failure of the supplementation was almost certainly caused by the fact that birthweights in the control group were considerably higher than expected and were probably normal for black infants. These characteristically have

lower mean birthweights than the national norm. The high-protein supplement given to one group of mothers was disturbingly associated with lower birthweights in preterm infants, an excess of very early deliveries, and an increased mortality among these infants. If similar findings had not been present in other studies providing high-protein supplements, these results might be dismissed as an artifact of sampling.

Another major study carried out in Guatemala, where severe maternal undernutrition is the rule, demonstrated that a primarily caloric supplement was as effective as one of calories and protein in improving birthweights and subsequent infant growth. This same study failed to demonstrate any measurable effect on mental development.

The assumption that even moderate degrees of undernutrition in early life result in later physical and mental handicaps has been used to create and expand some of the most popular food programs and is still used to promote them. Extensive research has failed to produce convincing evidence to the effect that the inferior intellectual attainments found in children, who were severely malnourished in early life, are the result of the malnutrition and not of the grossly deprived environments in which the children live.

Recent studies have confirmed the 43-year-old observation that healthy black infants have 0.5 to 1.0 gm/100 ml lower hemoglobin levels than healthy white infants after 4 months of age: this has generally been ignored, resulting in the classification of many normal black infants as anemic. Recent analyses of extensive national data have revealed that high maternal hemoglobin (and hematocrit) levels are associated with as many or more abnormalities of pregnancy outcome as low hemoglobins, and that the *ideal* hemoglobin level for pregnant black women is 0.5 to 1.0 gm lower than for white women. A transferrin saturation of less than 15% is commonly used to classify infants and children as iron-deficient, despite the fact that, in this age group, in the absence of anemia, a level of 7% saturation has been found to be the lower limit of normal.

There is a lack of scientifically acceptable documentation and an abundance of testimonial evidence as to the benefits of WIC and other programs. This leaves them open to the claim that they may only be aggravating existing overnutrition, or that the use of inappropriate controls and the inclusion among the recipients of so many who were not undernourished, or were actually overnourished to begin with, is giving a falsely optimistic picture of improved birthweights, of decreased incidences of low birthweight, of falling neonatal mortality rates, and of better infant and child *growth* rates. The great difficulties inherent to the evaluation of any single program, in populations who are beneficiaries of other programs and are undergoing constant change in status, tend to discourage such evaluations. The emotionalism that surrounds such programs is also a deterrent.

This absence of adequate documentation of the benefits generally assumed to accrue from feeding programs in the United States, combined with the evidence of possibly undesirable effects, makes them understandably susceptible to curtailment or actual elimination at times of fiscal restraint. Many of the collateral benefits reported from these programs, such as improved school attendance, better utilization of prenatal

and well-baby care services, improved immunization status, and decreased incidences of iron-deficiency anemia, are in themselves worthy goals. The question must be asked, however, if these could not be attained by other more accurately targeted and less costly methods. There is no reason to doubt that when programs such as WIC are properly run, with careful selection for participation of those who are indeed at nutritional risk, they should produce tangible benefits. With the growing experience in nutrition surveillance methodologies and with the potential for efficient follow-up of all infants born alive in this country, it should be possible to identify in time the small minority that is not thriving, and to take appropriate preventive and remedial steps. It is likely that proper investigation of the causes of poor nutritional status will reveal that broad supplemental food programs are, at best, stopgap measures that constitute one of the less important components of the steps to be taken. There is the danger that exaggerated emphasis on nutrition as a major priority has diverted national attention and resources away from other more pressing problems affecting the health, well-being and future social competence of our children and youth.

It is apparent that important research findings of the past decade have not consistently found their way into national or local policies, and that there is a scarcity of individuals trained in the application of nutrition knowledge to public health practice. Appropriate policies require correct definition of nutrition problems and their health implications, accurate estimates of prevalence and distribution, scientifically-based decisions between broad food programs aimed at highly prevalent nutrition problems and efficient case-finding for sporadic problems requiring well-targeted multidisciplinary efforts, and continuing scientific evaluations of existing programs.

This analysis assumes that adult obesity is a health hazard, and that overweight in infancy and early childhood contributes to its development by increasing the number of fat cells in the body and by creating life-long habits of overeating. The adverse implications of adult overweight, for a long time considered as proven, recently have been questioned: it is apparent that proper clarification of this issue is basic to a proper understanding of the implications of childhood obesity. Additional research is needed before the role of infant overweight in producing anatomic and functional changes that predispose to adult obesity is clearly established. It must be determined, as well, to what degree excess weight for height in childhood represents an excess of body fat. Anthropometric measures need to be properly correlated with accurate estimates of body composition, in order to refine methods of field assessment. Studies of racial, cultural, economic and psychological determinants of attitudes toward food and obesity are basic to any successful approach to this problem in a nation with such a heterogeneous population. The safety of the many diets and *special foods* being promoted for weight control deserves careful attention.

The role of diet in the genesis of degenerative vascular diseases has been a major research concern for much longer than the past decade. Despite this, and despite many authoritative statements and some acrimonious public airing of disagreements, we are no closer to knowing whether there are any sound reasons for infants and children with normal lipid metabolism to restrict their intakes of cholesterol, saturated fats and simple sugars, and to increase their intakes of dietary fiber, however

defined, to forestall the later occurrence of these diseases. Even in children with essential hypercholesterolemia, the recent unravelling of the genetic defect, which results in increased intracellular synthesis of cholesterol, would not seem to indicate any major benefits to be expected from dietary cholesterol restriction. As far as dietary fiber is concerned, the evidence for its role in the prevention of some bowel diseases is quite convincing.

The potential role of specific foods, food components, and food additives in the etiology of various malignancies has been suggested by epidemiologically determined associations, and, in some cases, by animal experimentation. This undoubtedly will be a major research preoccupation in this decade and beyond. Epidemiologists are fully conscious of the pitfalls in attributing cause and effect relationships to statistically significant associations, particularly in the complex multifactorial realm of oncogenesis, but other health professionals and the public at large usually do not share the same cautions. There will be an increasing responsibility for proper interpretation of new research findings, and, when indicated, for their implementation in making food policy.

During the past decade the essentiality for man of a number of the trace minerals has been established, and some clinical deficiency syndromes have been recognized. Preliminary research to establish normal blood and tissue levels is being carried out, but much more needs to be learned: content and bioavailability in different foods, factors regulating absorption, interrelations among different minerals, age-specific requirements, stores, transport, function, excretion, toxicity, and adverse effects of excesses and of imbalances. The intense preoccupation of the public with the adequacy of the diet lends itself to premature application of incomplete knowledge and to exploitation. Although the essentiality of iron long has been established, the research findings of the last few years about dietary factors affecting its absorption is already bringing about a revision of our definition of requirements at different ages and in relation to other dietary components. This constant evolution in our knowledge about this one nutrient should remind us of how much needs to be learned about the other trace minerals. The possible adverse effect of iron administration on the vitamin E status of premature infants also should introduce an element of caution.

The identification of normal race- and age-dependent loss of the major intestinal lactase activity led, at times, to exaggerated concern for its public health significance, and to an injudicious avoidance of milk-based formulas in the feeding of premature infants with soy-based substitutes not appropriate for this vulnerable group. It also contributed to a considerable expansion of research into normal mechanisms of intestinal absorption and the role therein of the gastrointestinal flora. The availability of stable isotopes and of methods for their accurate determination has given a strong impetus to research on normal and altered gastrointestinal function.

The development of methods and materials for total parenteral alimentation has contributed to the improved nutrition and healthy survival of many infants and children. It also has forced many in the medical profession to become familiar with

normal nutrient requirements and those of altered physiologic states, as well as with deficiency states resulting from the omission of essential fatty acids, vitamins and minerals. There is the risk, however, that the ready availability of these new methods actually may hinder the profession's understanding of gastrointestinal function and the proper utilization of limited or altered capacities to handle orally ingested nutrients. By turning over the nutritional management of complex cases to parenteral nutrition *teams*, many professionals fail to develop a proper understanding of nutrient requirements and their alteration by disease.

The well-known association between malnutrition and infection has stirred considerable enthusiasm for research into the mechanisms involved in both directions: the effects of infection on nutrient requirements and the effects of protein-calorie malnutrition and of iron and zinc deficiencies on the incidence and severity of infections. Whereas additional studies of humoral mechanisms generally have been unproductive, those of cell-mediated immunity are revealing a number of potentially important alterations. Much remains to be done, particularly in the establishment of clinical correlates of the research findings.

In their search for a healthier existence, growing numbers of people avidly follow the scientific nutrition literature, the all-too-frequent releases of preliminary research results, the reporting of suggestive epidemiologic associations, or frankly irresponsible and exploitative announcements. Many have developed an almost irrational fear of all food processing and food additives, or have taken to their farthest limit recommendations made about limiting intakes of certain foods or food components, or have espoused cults that follow extreme food avoidances. For many, the yearning for the *simpler life* of the *good old days* has resulted in *back-to-nature* food preparation and consumption practices. Although many of these practices are possibly the result of wise caution by mature individuals, other practices, such as the most extreme forms of vegetarianism, the avoidance of processed foods and of additives, and the home preparation of certain key foods, when applied to infants and small children, already are resulting in an alarming resurgence of rickets and the appearance of severe cases of protein-calorie malnutrition, of vitamin deficiencies, and of very poor growth.

At the other extreme of the picture is the increasing reliance of the American people on convenience foods, viewed with great alarm by traditional home economists, dieticians, and nutritionists. Along with the near-legislation of the *basic four* into programs, such as school lunch, there is the labelling as "junk foods" of items such as cheeseburgers and pizza, which, if available throughout the developing world at the same relative low cost and same level of quality and safety, would go very far to improve the nutritional status of their childhood populations. The trend to convenience foods in the United States is very much a part of inevitable and irresistible social change and of the liberation of the American woman from many traditional household chores. It seems more important to assess and recognize the importance of such foods in children's diets, to make certain of their nutritional value and safety, and to be able to inform the public intelligently about the same, than merely to lament about change.

The United States scientific community and much of the public have rediscovered human breast milk as the ideal food for the human infant. Its protective elements against infection, the much greater availability of its nutrients, notably iron and zinc, and the psychological benefits to mother and infant of a successful and happy lactation have resulted in an enthusiasm that, at times, borders on the irrational. Almost forgotten is the fact that several generations of American infants have thrived physically and emotionally on artificial feeding, that artificial feeding need not be equated with overfeeding, that many mothers are not physically and emotionally prepared for breastfeeding, and that not all infants thrive on their mother's breast. There is no justifiable need to make mothers in this country feel guilty or inadequate because they do not wish or are unable to feed their infants successfully at the breast. Reports are beginning to appear of infants becoming severely marasmic as the result of their desperate mothers' persistence in failed attempts to breastfeed. Forgotten also is the fact that dark-skinned infants fed exclusively at the breast in temperate climates can and do develop rickets. The understandable desire to provide the advantages of breast milk to tiny premature infants, even when it is banked mature milk, has forced a necessary reexamination of these infants' nutrient requirements, notably for protein and minerals; and of the ability of colostrum, transitional breast milk, mature breast milk, and various formulas to satisfy these requirements without the risk of providing potentially dangerous excesses of water or certain nutrients. The needed research is underway and needs to be continued.

Although most health professionals have been, and continue to be, extremely reluctant to accept the concept that childhood hyperactivity might be caused by food additives or natural components of various foods, some professionals are mildly to strongly convinced that this is the case in at least a minority of cases of this ill-defined diagnosis. On the other hand, a large number of parents are firmly convinced of the benefits of the time-consuming and difficult avoidance diets that are commonly recommended. The subject cannot be easily ignored and probably deserves carefully designed studies that will lead to results that are as definitive as they can possibly be.

It is apparent that, although much has been learned about nutrition and its relationship to growth, we are still far from being able to define the plane of nutrition that will be associated with the greatest useful and healthy longevity. This difficult question deserves major attention despite the enormous problems inherent to long-term studies.